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EVALUATION OF PHYTASE RESISTANCE IN SWINE DIETS TO DIFFERENT PELLETING TEMPERATURES

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It has been demonstrated that phytase present in high levels in some cereals such as rye and microbial phytase produced by Aspergillus niger increase the bioavailability for monogastric animals of phytic phosphorus. Most of the diets used nowadays are steam-pelleted. This is done for nutritional and sanitary reasons. The resistance of endogenous phytase and eventually that of the added one to the pelleting temperature appeared as an important question.
The aim of the present work was to evaluate the effects on phytase activity of steam-pelleting.
Two swine commercial diets (piglet - A and sow - B) were used. Phytase was determinated in the mash basal diets, after addition of 250 phytase units from Aspergillus niger per kg of feed and after stream-pelleting of the supplemented diet from 50, 55, 60, 65, 70, 75 and 80°C. It appeared that steam-pelleting at temperatures higher than 60°C strongly reduced phytase activity. This was particularly marked for temperatures higher than 75°C. When pelleting at 80°C the recovered phytase activity represented about 50 % of the endogenous one demonstrating inactivation of both enzymatic activities.

Key-words: Phytase, pelleting, temperature, resistance

INTRODUCTION

Most of the phosphorus present in vegetables, particularly in legume seeds occurs as phytate-phosphorus. Phosphorus in this form is poorly available in simple-stomached animals (Reddy et al., 1982).
It has been demonstrated that phytase present in high levels in some cereals such as rye (Pointillart et al., 1987) and microbial phytase produced by Aspergillus niger (Simons et al., 1990; Simões Nunes, 1992; Cromwell et al., 1993) increase the bioavailability for monogastric animals of phytic phosphorus.
Most of the diets used nowadays are steam-pelleted. This is done for nutritional and sanitary reasons. The resistance of endogenous phytase and eventually that of the added one to the pelleting temperature appeared as an important question (Simons et al., 1990).

Thus, the aim of the present work was to evaluate the effects on phytase activity of steam-pelleting.

MATERIAL AND METHODS

Two swine commercial diets (piglet - A and sow - B) were used. Phytase was determinated in the mash basal diets, after addition of 250 phytase units from Aspergillus niger per kg of feed and after steam-pelleting of the supplemented diet from 50, 55, 60, 65, 70, 75 and 80°C. One unit of phytase (U) has been defined as the quantity of enzyme liberating 1 μ mol inorganic phosphorus per minute from 0.0015 mol sodium phytate at 37°C and pH 5.5. Pelleting was performed in a DFPL 8 A - 989 laboratory press with a steam direct injection DADA-1 (Bühler Frères SA, Uzwil, Switzerland). The press dies had a diameter of 6 mm and a length of 30 mm. The pellets were dried and cooled for 15 min in a dryer-cooling OTW - 150 (Bühler Frères SA, Uzwil, Switzerland).
For each sample 4 determinations of phytase activity were performed. The intra-sample activity variability was less than 4%.

RESULTS, DISCUSSION AND CONCLUSIONS

The following table summarizes the results obtained:

Phytase activity (PU/kg) in diets A and B. M - basal mash diet; MP - idem + 250 PU/g; 50 to 80 - MP pelleted at the corresponding temperature.

	M	MP	50	55	60	65	70	75	80
A	140	372	360	360	350	310	290	170	80
% MP	38	100	97	97	94	83	78	46	22
B	410	680	680	630	610	550	400	300	140
% MP	60	100	100	93	90	81	59	44	21

It appeared that steam-pelleting at temperatures higher than 60°C strongly reduced phytase activity. This was particularly marked for temperatures higher than 75°C. When pelleting at 80°C the recovered phytase activity represented about 50 % of the endogenous one demonstra-

ting inactivation of both enzymatic activities. These observations are in agreement with those of Simons et al. (1990) and of Latimier and Pointillart (1992).
Thus, with the aim of phytase preservation in pig feed technological precautions should be taken when using steam-pelleting.

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